PROJECT SUMMARY SHEET (29 Mar 07)

PROJECT TITLE NAME: Lake Campbell Post Assessment

LEAD PROJECT SPONSOR: East Dakota Water Development District
132B Airport Drive
Brookings, SD 57006

STATE CONTACT: Barry McLaury **TITLE:** Environmental Program Scientist
PHONE: 605-773-5859 **FAX:** 605-773-4068
EMAIL: Barry.McLaury@state.sd.us

STATE: South Dakota **WATERSHED:** Central Big Sioux River Basin
HUC: 10170203

PROJECT TYPE: ☐ Base ▩ Watershed ☐ Groundwater ☐ I&E

WATERBODY TYPES:

- ☐ Groundwater
- ▩ Lakes/Reservoirs
- ☐ Rivers
- ☐ Streams
- ☐ Wetlands

NPS CATEGORY:

- ☐ Urban Runoff
- ▩ Agriculture
- ☐ Silviculture
- ☐ Construction
- ☐ Resource Extraction
- ☐ Stowage/Land Disposal
- ☐ Hydrologic Modification
- ☐ Other

PROJECT LOCATION: Latitude: N 44.21134 Longitude: W -96.84216

SUMMARIZATION OF MAJOR GOALS:
The Lake Campbell Post Assessment will be a comparative analysis between previous watershed conditions and present conditions as a result of the Lake Campbell Dredging Project that occurred between 1987 and 1989. This assessment will be used to determine current ecological status, the influence of previously implemented BMPs and to determine the effectiveness for those restoration activities that have taken place. This project will incorporate previous and current water quality data to produce a TMDL for trophic state and trend.

PROJECT DESCRIPTION:
Lake Campbell is an 800-acre glacial outwash lake located five miles southwest of Brookings, South Dakota. Battle Creek discharges into the south end of the lake, and accounts for nearly all of the discharge from the 112,560 acres of watershed. This project will provide current information and documentation regarding water quality through testing of past sampling sites that were established prior to restoration activities of the lake. A follow up analysis will be conducted to obtain information about the effectiveness of watershed BMP implementation for future lake restoration projects.

Federal Funds Requested: $56,583 **Non-Federal Match: $34,297**
Other Federal Funds: $0 **Total Project Cost: $90,880**

2.0 STATEMENT OF NEED

2.1 The purpose of the Lake Campbell Post Assessment is to determine present water quality status after being dredged in the late 1980's and after restorations activities were conducted. Recent ambient water quality testing indicates a non-supporting Trophic State Index due to high nutrients. In recent years this lake has experienced severe algae blooms. Several residents of the area have expressed concerns over declining water quality.

2.2 Lake Campbell was initially identified in the 1996 South Dakota Report to Congress 305(b) Water Quality Assessment as hypereutrophic due to excessive nutrients, siltation, and noxious aquatic plants. Since that time, it has been listed as impaired in subsequent reports as well as listed on the South Dakota 303(d) Waterbody Lists. Lake Campbell was most recently identified in the 2006 Integrated Waterbody List for TMDL development due to TSI trend and not supporting of its Warmwater Marginal Fish Life beneficial use.

The lake itself is 800 acres in size. The area of its watershed is approximately 112,560 acres and lies within portions of three South Dakota counties, south-central Brookings County, north-west Moody County, and north-east Lake County (Figure 1). According to the 1993 Diagnostic/Feasibility Study Report of the Lake Campbell/Battle Creek Watershed drains nearly 100 percent of the watershed, which discharges into Lake Campbell from the south. The majority of the nutrients and sediment load is believed to be loadings from Battle Creek which drains 91 percent agricultural land.

The following table lists the state and federally endangered, threatened, and rare species that may occur in the area.

Table 1. Rare, Threatened and Endangered Species in the Lake Campbell Area

			STATUS		
NAME	**SCIENTIFIC NAME**	**CATEGORY**	**FEDERAL**	**STATE**	**OCCURRENCE**
Whooping Crane	*Grus americana*	Bird	FE	SE	Rare
Bald Eagle	*Haliaeetus leucocephalus*	Bird	FT	ST	Known
Topeka Shiner	*Notropis topeka*	Fish	FE		Known
Central Mudminnow	*Umbra limi*	Fish		SR	Known
Trout Perch	*Percopsis omiscomaycus*	Fish		SR	Known
Northern Redbelly Dace	*Phoxinus eos*	Fish		ST	Known
American Burying Beetle	*Nicrophorus americanus*	Insect	FE	SR	Rare
Dakota Skipper	*Hesperia dacotae*	Insect	FC	SR	Rare
Western Prairie Fringed Orchid	*Platanthera praeclara*	Plant	FT		Rare
Northern Redbelly Snake	*Storeria occipitomaculata occipitomaculata*	Reptile		SR	Known
Black-Footed Ferret	*Mustela nigripes*	Mammal	FE	SE	Rare

KEY TO CODES:

FE = Federal Endangered	SE = State Endangered
FT = Federal Threatened	ST = State Threatened
FC = Federal Candidate	SR = State Rare

2.3 See the map in Figure 1.

2.4 Landuse in the watershed is mainly agricultural and consists of livestock and crop production. The lake itself is a highly recreational lake used for fishing and boating. Major recreational areas around the lake include the South Shore swimming beach, as well as a golf course on the northeast side of the lake.

2.5 The Lake Campbell watershed lies entirely within the Prairie Coteau of the Northern Glaciated Plains in the Level III Ecoregion, which is characterized by gently rolling hills composed of glacial drift interspersed with numerous small potholes and intermittent streams. The typical geology of this region is comprised of glacial till over Cretaceous Shales. The soils of the area are well-drained and consist of silty, clay loams. Egan, Wentworth-Sinai, and Dempster are the main soil types in this area.

The average annual precipitation in the watershed is 22.8 inches, of which 78 percent usually falls from April through September. Tornadoes and severe thunderstorms occasionally strike. These storms are local and of short duration and occasionally produce heavy rainfall events.

2.6 The purpose of this assessment is to assess the results of the dredging project, develop a TMDL for TSI trend, and suggest recommendations to improve the water quality of Lake Campbell.

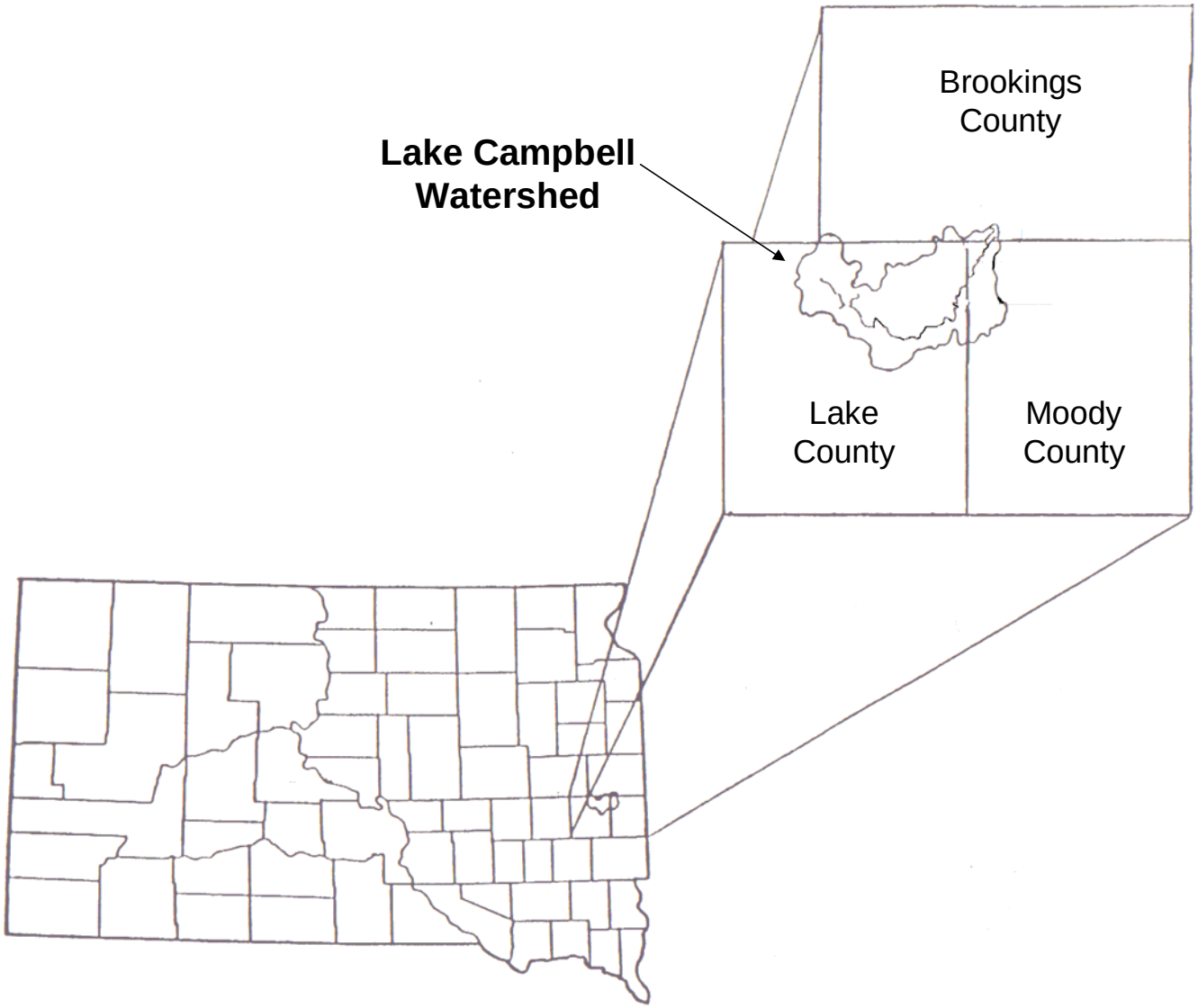


Figure 1. Lake Campbell Watershed

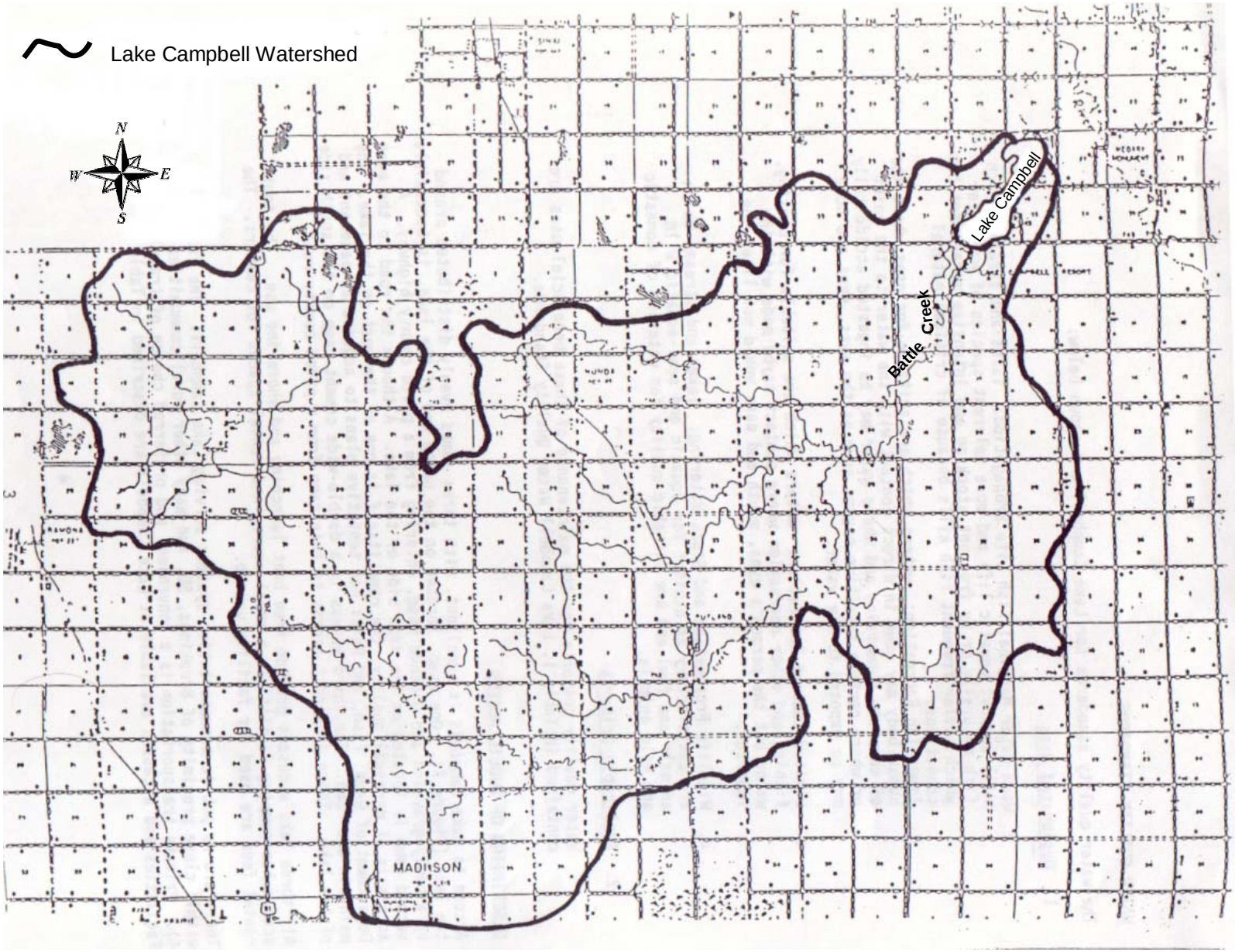


Figure 2. Boundaries of the Lake Campbell Watershed

3.0 PROJECT DESCRIPTION

3.1 GOALS

The goals of the Lake Campbell Post Assessment are 1) Provide current documentation of water quality, 2) Determine the effectives o f previous dredging and restoration activities, 3) Examine present watershed BMP effectiveness using landuse simulation models, and 4) produce a TMDL for trophic state and trend to improve water quality by reducing sediment and nutrient loading to the lake. This project will produce the information needed for planning future restoration of the lake. Reducing non-point pollutants in the watershed will improve the water quality of the lake, improve the habitat for aquatic species, and improve the recreational use of the lake.

3.2 OBJECTIVES AND TASKS

OBJECTIVE 1: **Lake Assessment**

Assess the current water quality of Lake Campbell. This information will be used to (1) compare with past studies to document improvement of water quality (2) determine whether or not numeric and narrative water quality standards are being maintained, (3) estimate the nutrient and sediment trapping, and (4) examine current productivity levels, i.e. trophic state, for the lake. The amount of reduction needed to improve the lake will also be calculated.

TASK 1: Collect in-lake water quality samples.

Parameters including nutrients, solids, and pathogens will be sampled at three in-lake sites that were previously monitored on Lake Campbell (See Figure 3). The South Dakota State Health Laboratory in Pierre will analyze all water quality parameters. Samples will be collected from the surface of the lake on a monthly basis for one year, except when the ice is deemed unsafe. During June, July, and August, samples will be collected twice each month. The water samples will be collected using sample bottles which will be iced and shipped to the appropriate laboratory for analysis. A total of 45 samples (of each parameter) will be collected from the three in-lake sites (Figure 3).

Both dissolved oxygen and temperature water column profiles will be collected at all in-lake sites on a monthly basis, except during June, July, and August, when samples/measurements will be collected twice per month. Additionally, pH, turbidity, air temperature, salinity, conductivity, general climatic information, and Secchi disk measurements will be taken at each site. All samples/measurements will be collected using methods described in the WRAP SOP.

The in-lake sites will also be monitored for chlorophyll-*a* and algae. Chlorophyll-*a* will be collected once per month in April, May, and September; and twice per month in June, July, and August during regularly scheduled water quality sampling. Algae will be sampled in mid June, July, and August. The chlorophyll-*a* and algae samples will be analyzed by the SD DENR in Pierre.

TASK 2: Conduct a macrophyte and shoreline survey of Lake Campbell.

This task will be completed only once during the late summer months (July or August). Macrophytes will be sampled for the lake with a plant grapple/rake. A depth finder will be used to locate macrophyte beds and determine area of coverage of submerged vegetation. Macrophyte density and species composition will be recorded.

TASK 3: Perform a sediment survey of Lake Campbell.

A sediment survey will be accomplished using a sediment probe through the ice. This task will be completed once during the winter in January or February.

A. LAKE SAMPLING LOCATIONS

SITE	LOCATION	
LC-1 Lake Campbell I	Lat: 44.22100	Long: -96.84041
LC-2 Lake Campbell II	Lat: 44.21134	Long: -96.84231
LC-3 Lake Campbell III	Lat: 44.19720	Long: -96.85950

B. IN-LAKE PARAMETERS TO BE SAMPLED

PHYSICAL	CHEMICAL	BIOLOGICAL
Air Temperature	Alkalinity	Fecal Coliform Bacteria
Water Temperature	pH	*E-Coli*
Secchi Depth	Dissolved Oxygen	Chlorophyll-*a* (phytoplankton)
Water Depth	Total Solids	Aquatic Macrophytes
Turbidity*	Total Dissolved Solids**	Algae
Visual Observations	Total Suspended Solids	Ash-free dry mass (phytoplankton)
Secchi Depth	Volatile Total Suspended Solids	
	Ammonia	
	Conductivity	
	Total Kjeldahl Nitrogen	
	Nitrate-Nitrite	
	Total Phosphorus	
	Total Dissolved Phosphorus	

* if probe available on sampling sonde
** calculated value

QUALITY ASSURANCE/QUALTIY CONTROL

Approved QA/QC procedures will be utilized on all sampling and field data collected on the Lake Campbell Post Assessment. Refer to the South Dakota Watershed Protection Program Quality Assurance Project Plan and the Standard Operating Procedures for Field Samplers for the State of South Dakota DENR Water Resources Assistance Program for the details of the procedures to be followed.

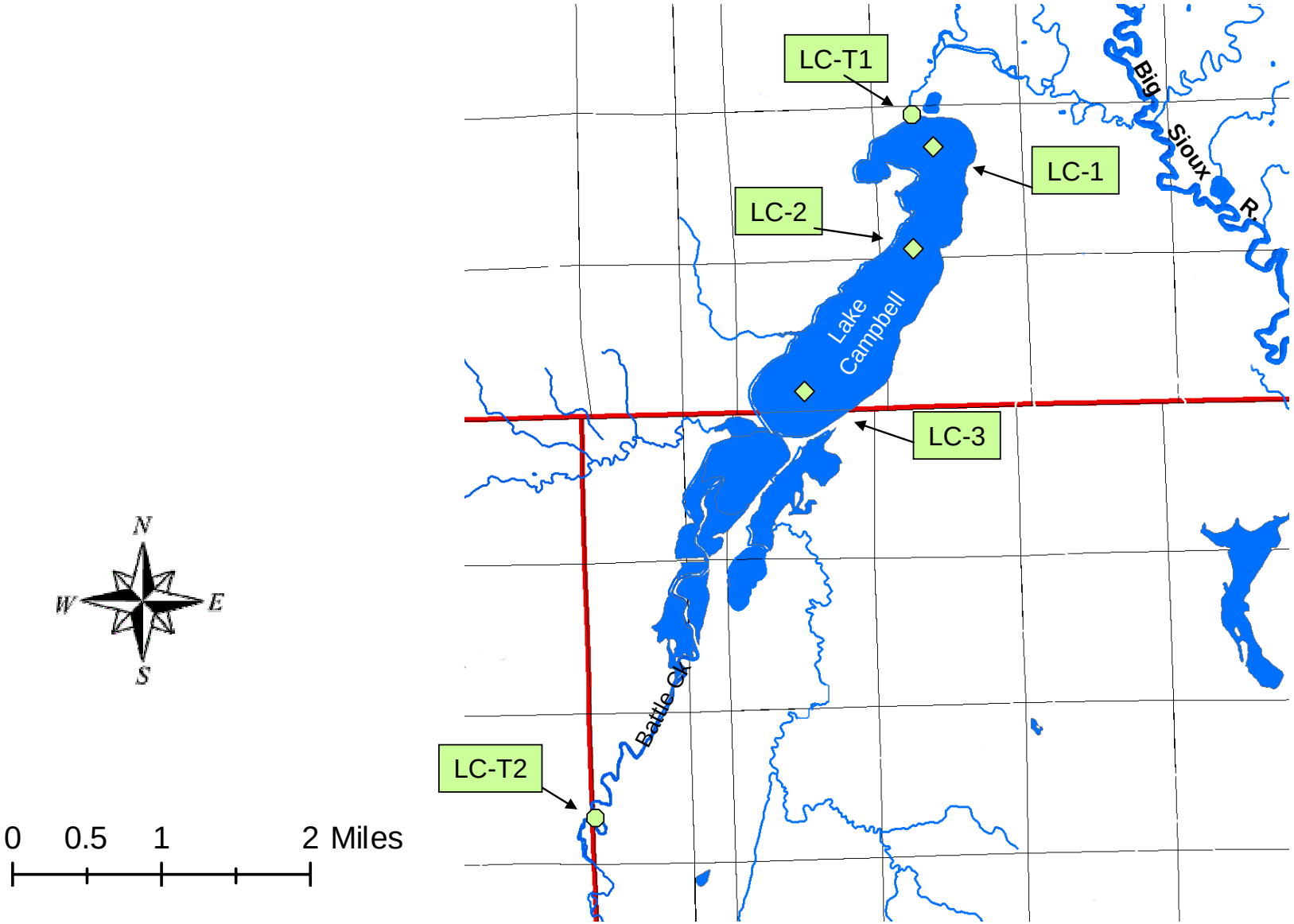


Figure 3. Monitoring Locations in the Lake Campbell Watershed

C. OUTPUTS

In-lake water quality report
Watershed water quality report that shows a comparative analysis prior to and after dredging
Statistical evaluation of water quality and biological data for the lake and tributaries
Calculations of trophic state using Carlson's Trophic State Index
Dissolved oxygen and water temperature profiles
Aquatic macrophyte map
Sediment volume and distribution map

D. COST $ 18,109

E. RESPONSIBLE AGENCIES

Task Responsibility
Project Coordinator
Project Sponsor

Design and Technical Assistance
South Dakota Department of Environment and Natural Resources

F. WORK ACTIVITIES

In-lake water samples will be collected and shipped in accordance to the methods described in the Standard Operating Procedures for Field Samplers by the State of South Dakota Watershed Protection Program. Algae and chlorophyll-*a* data will be analyzed and compared to the water quality. A survey of aquatic vegetation will be conducted. The various samples will be analyzed by the State Health Laboratory, the SD DENR, and project staff. The water quality data will be integrated with the biological data to provide an analysis of the lake.

OBJECTIVE 2: Hydrologic and Water Quality Inflow/Outflow Monitoring of Lake Campbell

Collect discharge measurements and water quality samples/measurements from all identified inputs and outputs to estimate the water quality parameter loadings of the Lake Campbell watershed.

TASK 4: Install water level recorders.

Water level recorders will be installed at a predetermined input point and at the outlet, to monitor water movement into and out of Lake Campbell during the period of the assessment.

TASK 5: Develop hydrographs for water inflow and outflow of Lake Campbell.

Discharge measurements will be taken at the inlet and the outlet. These measurements will be taken with a hand-held current velocity meter. In addition to monitoring the outflow of the lake, lake elevation measurements will be collected on a regular basis, using a pre-determined benchmark.

Discharge measurements and water level data will be used to develop flows for all water quality sampling times. A hydrologic budget will be calculated for the lake.

A. INFLOW/OUTFLOW SAMPLING LOCATIONS

SITE	LOCATION	
LC-T1 Lake Campbell Outlet	Lat: 44.22384	Long: -96.84250
LC-T2 Battle Creek	Lat: 44.15870	Long: -96.88899

An estimated 16 samples from each location, for a total of 32 samples, which includes baseflow and runoff sampling, may be collected from these areas (Figure 3).

B. INFLOW/OUTFLOW PARAMETERS TO BE SAMPLED

PHYSICAL	CHEMICAL	BIOLOGICAL
Air Temperature	Alkalinity	Fecal Coliform Bacteria
Water Temperature	pH	*E-Coli*
Water Depth	Dissolved Oxygen	
Turbidity	Total Dissolved Solids (calculated value)	
Visual Observations	Total Solids	
	Total Suspended Solids	
	Volatile Total Suspended Solids	
	Ammonia	
	Nitrate-Nitrite	
	Total Kjeldahl Nitrogen	
	Total Phosphorus	
	Total Dissolved Phosphorus	
	Conductivity	

QUALITY ASSURANCE/QUALTIY CONTROL

Approved QA/QC procedures will be utilized on all sampling and field data collected on the Lake Campbell Assessment. Refer to the South Dakota Watershed Protection Program Quality Assurance Project Plan and the Standard Operating Procedures for Field Samplers for the State of South Dakota Clean Lakes Program for the details of the procedures to be followed.

C. OUTPUTS

Watershed water quality report
Hydrologic and water quality parameter loads into and out of Lake Campbell

D. COST $ 11,231

E. RESPONSIBLE AGENCIES

Task	Responsibility
Project Coordinator	
Project Sponsor	

Design and Technical Assistance
South Dakota Department of Environment and Natural Resources

F. WORK ACTIVITIES

Inflow/outflow water samples will be collected and shipped in accordance to the methods described in the Standard Operating Procedures for Field Samplers by the State of South Dakota Watershed Protection Program. Hydrometers will record fluctuating water levels. The water quality data will be integrated with the hydrologic data to provide an analysis of the input to and the output of the lake.

OBJECTIVE 3: Quality Assurance/Quality Control

Ensure that all water quality samples are accurate and defendable through the use of approved Quality Assurance/Quality Control procedures.

TASK 6: Collect Required QA/QC Samples.

A minimum of 10 percent of all water quality samples collected will be QA/QC samples. QA/QC samples will consist of field blanks and field duplicates. An estimated 16 samples (eight blank, eight duplicate, of each parameter) will be collected during the project. The collection of all field water quality data will be accomplished in accordance with the Standard Operating Procedures for Field Samplers, South Dakota Non-Point Source Program.

The activities involved with the QA/QC procedures and the results of the QA/QC monitoring will be complied and reported in the final assessment report.

A. OUTPUTS

A Quality Assurance/Quality Control Monitoring Report.

B. COST $5,206

C. RESPONSIBLE AGENCIES

Task Responsibility
Project Coordinator
Project Sponsor

Design and Technical Assistance
South Dakota Department of Environment and Natural Resources

D. WORK ACTIVITIES

Approved QA/QC will be utilized on all sampling and field data collected during the Lake Campbell Post Assessment Project. Refer to South Dakota Watershed Protection Program Quality Assurance Plan and the South Dakota Watershed Protection Program Standard Operating Procedures for Field Samplers for details of the procedures to be followed.

OBJECTIVE 4: **Landuse Evaluation**

Evaluate the potential impact of the agricultural land uses on the water quality using the Ann-AGNPS model. This model is used to identify critical areas within the watershed and to estimate soil and nutrient loss.

TASK 7: Documentation of the current status of previously funded Best Management Practices (BMPs) will be completed using the Ann-AGNPS model. This model will evaluate the assessment information, re-assessment information, and the future needs of Lake Campbell.

TASK 8: Collect data and run the Ann-AGNPS model.

Information will be gathered to define the physical characteristics of the watershed (topography, soils, geology, hydrology, etc.) Current landuse information will also be collected, to include current feedlot operations. Various BMP scenarios will be run to compare to the current conditions of the Lake Campbell Watershed.

A. OUTPUTS

Predictions of sediment and nutrient loadings
Information in the impact of BMPs
Target areas still in need of restoration

B. COST $25,465

C. RESPONSIBLE AGENCIES

Task Responsibility
Project Coordinator
Project Sponsor

Design and Technical Assistance
South Dakota Department of Environment and Natural Resources

D. WORK ACTIVITIES

Information will be derived from prior assessments, public sources, state and federal agencies, and site visits. It is anticipated that significant data can be derived from information available on different information system (GIS) records. Data will be entered into the model and model scenarios completed to evaluate landuse impacts, relative to sediment and nutrient loading.

OBJECTIVE 5: **Public Participation and Involvement**

TASK 9: Conduct informational meetings.

Informational meetings will be held on a regular basis for the general public and local governmental entities. The meetings will present information on the progress and results of the assessment. These meetings will also provide an opportunity for the residents of the area to offer input.

A. OUTPUTS

Information and education about the project
Public input to the project
Involvement and/or input will be documented

B. COST $1,565

C. RESPONSIBLE AGENCIES

Task Responsibility
Project Coordinator
Project Sponsor

Design and Technical Assistance
South Dakota Department of Environment and Natural Resources

D. WORK ACTIVITIES

Informational meetings will be held on a regular basis for the general public, local governments (city, county, townships, and conservation districts) and the media to inform them of the progress of the study and to provide a means of public input.

OBJECTIVE 6: Data Evaluation and Reporting

TASK 10: Conduct an analysis of collected data.

As field data is collected, a concurrent review of historical data will be conducted, and project results will be integrated into a comprehensive database. Following the collection of all project data, loadings will be calculated and hydrologic, sediment, and nutrient budgets will be developed.

TASK 11: Prepare a GRTS report.

A biannual GRTS report will be written on the status of the project.

TASK 12: Provide a final report and TMDL.

Prepare a final report containing assessment results and management recommendations and establish a TMDL for Lake Campbell.

A. OUTPUTS

Results and analysis of data collected
Summation of activities in biannual report form
Assessment report covering history, methods, results, analysis, and management recommendations
TMDL report for Lake Campbell

B. COST $29,304

C. RESPONSIBLE AGENCIES

Task Responsibility
Project Coordinator
Project Administrator
Project Sponsor
South Dakota Department of Environment and Natural Resources

Design and Technical Assistance
South Dakota Department of Environment and Natural Resources

D. WORK ACTIVITIES

Statistical evaluation of data collected during the study. Review and compile historical data. Develop management recommendations. Produce graphic presentations of the data. Summarize the results into report format and calculate TMDL. Oversee project administration and project management.

3.3 MILESTONE TABLE - See attached.

3.4 No special permits are required to do this assessment project.

3.5 The East Dakota Water Development District is the appropriate lead project sponsor for this activity. The district has led local and regional efforts to identify, develop and protect water resources, especially within the Big Sioux River Basin.

3.6 No best management practices (BMPs) will be funded or implemented during this assessment project.

4.0 COORDINATION PLAN

4.1 The following groups/agencies have agreed through an informal agreement to cooperate in the Lake Campbell Assessment Project.

East Dakota Water Development District - Lead Project Sponsor
South Dakota Department of Environment and Natural Resources - Technical assistance
South Dakota Game, Fish, and Parks - Lake and fishery information
Lake Campbell Association - Lake information

4.2 This project will coordinate activities with state, federal, and local government agencies. Input and involvement in this assessment has been requested from SD Game, Fish, and Parks, NRCS, local organizations, and local government agencies.

4.3 Currently there are no other agencies conducting comparable assessment project activities in the Lake Campbell watershed.

5.0 EVALUATION AND MONITORING PLAN

5.1 The monitoring strategy is explained in Section 3. The project will produce biannual progress reports.

5.2 This assessment project consists of a combination of chemical, hydrologic, and biological analysis. Monitoring sites will be maintained and sampled on Lake Campbell and its watershed. Ambient samples will be collected in addition to spring runoff and storm events. Loadings will be calculated.

5.3 All water quality monitoring will be done in accordance with approved South Dakota Non-Point Source Quality Assurance/Quality Control Project Plan and the Standard Operating Procedures for Field Samplers for the South Dakota Watershed Protection Program.

5.4 Results from all water quality monitoring efforts under the Lake Campbell Assessment Project will be reported in the final project report. Data will be managed by the South Dakota Department of Environment and Natural Resources and maintained in a computer database. All sample data will be entered into the US EPA STORET database program by the SD DENR.

6.0 BUDGET

PART I - FUNDING SOURCE

Table 2. Lake Campbell Budget by Source

LAKE CAMPBELL ASSESSMENT PROJECT BUDGET	
Source	**Total**
FEDERAL FUNDS	$56,583
EDWDD FUNDS	$34,297
TOTAL BUDGET	**$90,880**

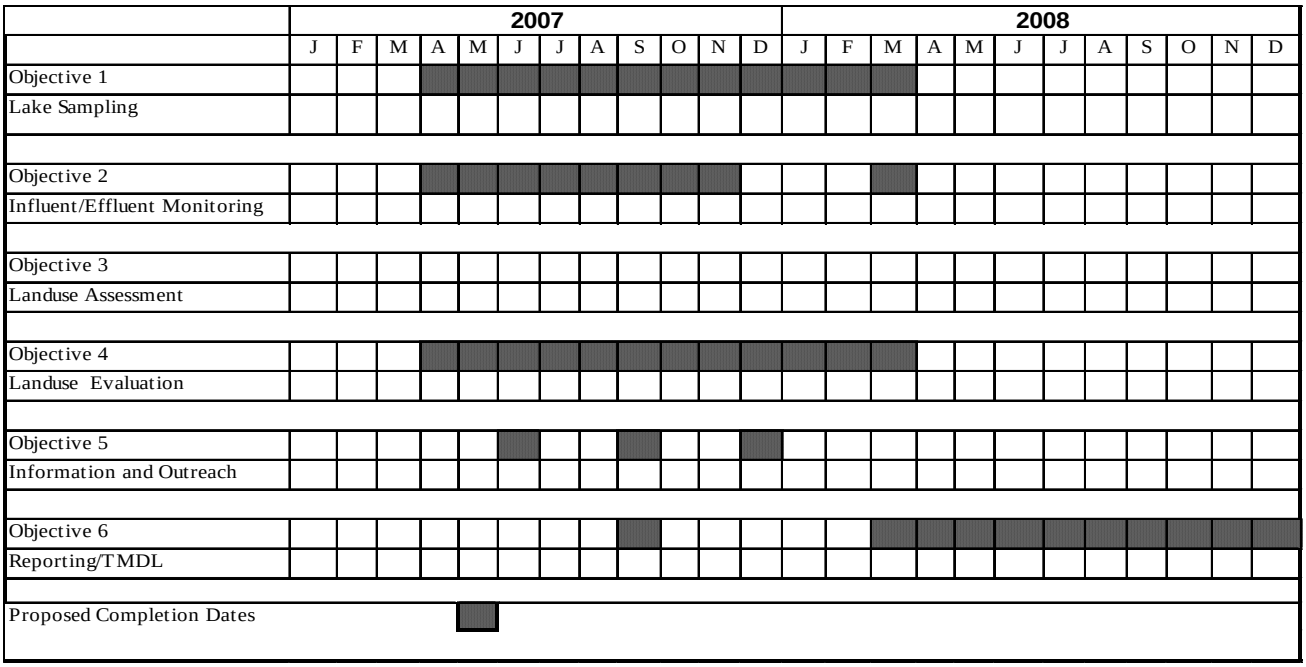
PART II - BUDGET

Table 3. Lake Campbell Budget

LAKE CAMPBELL ASSESSMENT BUDGET				
	Year 1	**Federal Funds**	**EDWDD Funds**	**Total**
1) Salary 1 @ $25/hr × 2302 hrs	$57,550	28,775	28,775	$57,550
1 @ $11.50/hr × 560 hrs	$6,440	3,220	3,220	$6,440
2) Administration 115.1 hrs @ $40/hr	$4,604	2,302	2,302	$4,604
3) Travel	$1,771	1,771		$1,771
4) Equipment	$302	302		$302
5) Shipping and Supplies	$2,150	2,150		$2,150
6) Contingencies	$300	300		$300
				$0
Objective 1: Lake Sampling				$0
Lab Analysis: 45 samples @ $191	$8,595	8,595		$8,595
				$0
Objective 2: Inflow/Outflow Sampling				$0
Lab Analysis: 32 samples @ $191	$6,112	6,112		$6,112
				$0
Objective 3: QA/QC				$0
Lab Analysis: 16 samples @ $191	$3,056	3,056		$3,056
Objective 4: Landuse Evaluation*				
Objective 5: Public Participation*				
Objective 6: Reporting*				
TOTAL	$90,880	$56,583	$34,297	$90,880

* Costs for these tasks are included in items 1-5 at the top of the table

Lake Campbell Post Assessment
East Dakota Water Development District
Milestone Chart
2007-2008



SOUTH DAKOTA NONPOINT SOURCE PROGRAM
QUALITY ASSURANCE PROJECT PLAN

SUBMITTED BY:

EAST DAKOTA WATER DEVELOPMENT DISTRICT

Prepared By: Deb Springman
March 2007

Project Title: Lake Campbell Post Assessment

APPROVED BY:

South Dakota Watershed Protection Program Environmental Senior Scientist, Assessment Section	Date
South Dakota Watershed Protection Program Project Officer	Date
South Dakota Watershed Protection Program Quality Assurance Coordinator	Date